Upon these principles Dr. Langer has constructed a complete plant on a Liliputian scale, which has been at work in my laboratory for a considerable time, and a photograph of which we will now throw on to the screen. You see here the volatilizing cylinder divided into numerous compartments, through which the ore is passing, and subjected to the action of carbonic oxide. At the bottom the ore is delivered into the transporting screw, passing through a furnace, and from this screw into an elevator, which returns the ore to the top of the cylinder, so that the ore constantly passes at a slow rate through the cylinder again and again, until the nickel it contains has been taken out. The carbonic oxide gas, prepared in any convenient manner, enters the bottom of the cylinder and comes out again at the top. It then passes through a filter to retain any dust it may carry away, and thence into a series of iron tubes built into a furnace, where they are heated to about 200° C. In these tubes the nickel carbonyl carried off by the carbonic oxide is completely decomposed, and the nickel deposited against the sides of the tubes is from time to time withdrawn, and is thus obtained in the pieces of tubing and the plates which you see on the table.

The carbonic oxide regenerated in these tubes is passed through another filter, thence through a lime purifier, to absorb any carbonic acid which may have been formed through the action of the finely-divided nickel upon the carbonic oxide, and is then returned through a small fan into the bottom of the cylinder. The whole of this plant is automatically kept in motion by means of an electric motor, and the gearing which you see here.

By means of this apparatus we have succeeded in extracting the nickel from a great variety of ores, in a time varying, according to the nature of the ore, between a few hours and several days.

Before the end of this year this process is going to be established in Birmingham on a scale that will enable me to place its industrial capacity beyond a doubt, so that I feel justified in the expectation that in a few months nickel carbonyl, a substance quite unknown two years ago, and to-day still a great rarity, which has not yet passed out of the chemical laboratory, will be produced in very large quantities, and will play an important *rôle* in metallurgy.

The process possesses, besides its great simplicity, the additional advantage that it is possible to immediately obtain the nickel in any definite form. If we deposit it in tubes we obtain nickel tubes; if we deposit it in a globe we obtain a globe of nickel; if we deposit it in any heated mould we obtain copies of these moulds in pure, firmly coherent, metallic nickel. A deposit of nickel reproduces the most minute details of the surface of the moulds to fully the same extent as galvanic reproductions. All the very numerous objects now produced by galvanic deposition, of which Mr. Swan exhibited here such a large and beautiful variety a fortnight ago, can thus be produced by this process with the same perfection in pure metallic nickel. It is equally easy to nickel-plate any surface which will withstand the temperature of 180° C. by heating it to that temperature and exposing it to the vapour, or even to a solution of nickel carbonyl, a process which may in many cases have advantages over electroplating. I have on the table before me specimens of nickel ores we have thus treated, of nickel tubes and plates we have obtained from these ores, and a few specimens of articles of pure nickel and articles plated with nickel which have been prepared in my laboratory. These will give you some idea of the prospects which the process I have described opens out to the metallurgist, upon whom, from day to day, greater demands are made to supply pure nickel in quantities. The most valuable properties of the alloy of nickel and iron called nickel-steel, which promises to supply us with impenetrable ironclads, have made an abundant and cheap supply of this metal a question of national importance. The inspection of the few specimens of articles of pure nickel and of nickel-plated articles will, I hope, suffice to show you the great facilities the process offers for producing very fine copies, and for making articles of such forms as cannot be produced by hydraulic pressure, the only method hitherto available for manufacturing articles of pure nickel.

The first practical use of the process has been made by Prof. Ramsay, who, for the purposes of a chemical investigation, made this beautiful little apparatus of pure nickel all in one piece, which he has kindly lent for exhibition to-night.

I began my lecture by bringing under your notice an idea of Liebig's which he published fifty-eight years ago. I have shown you how he himself elaborated this idea, and how it developed, until within recent years it has led to results of the highest scientific importance and probably of great practical utility.

Had Liebig all these results before his "mind's eye" when he penned those prophetic words I have quoted? This is a question impossible to answer. Who will attempt to measure the range of vision of our great men, who from their lofty pinnacle see with eagle eye far into the Land of Science, and reveal to us wonderful sights which we can only realize after toiling slowly along the road they have indicated? Whether Liebig saw all these results or not, it is due to him and to men like him that science continues its marvellous advance, dispersing the darkness around us, and ever adding to the scope and exactness of our knowledge, that mighty power for promoting the progress and enhancing the happiness of humanity.

NORTH-WESTERN DISTRICT OF BRITISH GUIANA.

At the meeting of the Royal Geographical Society on Monday evening, Mr. Everard im Thurn described the general characteristics of the new district in the north-west of British Guiana in the settlement and administration of which he has been employed for the last nine years. The colony of British Guiana he described as formed of a low swampy coast strip, often below the level of the sea, densely covered with mangroves, and intersected by rivers bound together by interlacing channels. Farther inland the mangroves pass into forests of tropical trees, which, as the land rises more steeply, are reduced to strips along the rivers, and finally merge into dry grassy uplands known as savannahs. The north-western district of the colony is officially defined as the territory bounded on the north by the Atlantic Ocean and the mouth of the River Orinoco; on the south by the ridge of land between the sources of the Amakuru, Barima, and Waini Rivers, and their tributaries, and the sources of the tributaries of the Cuyuni River; on the east by a line extending from the Atlantic Ocean in a southerly direction to the said ridge of land; on the south and on the west, by the Amakuru River and the line known as Schomburgh's line.

Mr. im Thurn's first task was to explore his territory, and this he did mainly by boat along the rivers and their connecting channels, traversing country never before visited by white men. The nature of this mode of travelling was very vividly described. On ascending the Moruka, the country on each side of the river was seen to become gradually more and more open—the river at last often winding through open savannahs, and broadening out here and there into pools so thickly set with water-lilies that the boat was forced through with difficulty. The waterway after some time leaves the river and passes along a narrow itabbo, or artificial water-path, which connects the Moruka with the Waini River. This connecting passage is about thirty miles long, and about ten miles is semi-artificial itabbo, made by the constant passage of the canoes of the Redmen through the swampy savannah, and very difficult to get through. Generally, it was hardly wider than the boat, and had many abrupt windings; the trees hung down so low over the water, that it was hard work either to force the boat under the low-lying branches, or to cut these away, and so make a passage. On either side of the channel the ground is so swampy as rarely to allow foothold of even a few inches in extent. The light hardly penetrates through the dense roof of leaves; and in the gloom under the roof only a few aroids, ferns, lilies, and orchids, and great masses of a palm previously undescribed could be described.

The itabbo passed, the boat turned suddenly into the Barabara River itself, at first narrow, but soon widening and winding on its course through dense and unbroken bush, chiefly composed of the graceful, swaying manicole palms (*Euterpe edulis*). Very abundant, perched high up and low down among this dense bush, were great quantities of an orchid with stems eight and nine feet long, loaded with its countless butterfly-like yellow flowers (*Oncidium altissimum*). After a few miles the Barabara River led into the Biara, a river of much the same character, which, though naturally larger than the Barabara, was still so small as hardly to deserve more than the local name of creek. And, again, in a few miles the Biara carried the boat into the Baramanni River, which is about 100 or 150 yards wide, and very deep. This is, in fact, not a river at all, but a very elongated lake or lagoon, of perhaps twenty miles in length, the lower end

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opening into the Waini, while the upper end discharges part of its surplus water into the sea. Anything more maze-like than the itabbo between the Waini and Barima Rivers it is impossible to imagine.

On the Aruka, a large tributary of the Barima, the curious Arawack game of the Macquari whip is played, the essential feature of which is a testing of endurance by means of alternately giving and receiving severe cuts with a somewhat severe whip. This extraordinary performance, accompanied with much drinking and with invariable good humour, is carried on for some days in accordance with a fixed ritual, the blows, which are received by the players on the calves of their legs, being so severe as to draw much blood. The river, too, must at one time have been the site of a Redskin civilization far superior to, and very different from, any known previously of the early inhabitants of Guiana; for there are on it considerable deposits of pottery ornamented with incised patterns, and even very abundantly with grotesque figures of men and animals in very high relief. To estimate the significance of this latter fact, it must be remembered that none of the known early inhabitants of Guiana have advanced in the important primitive art of pottery beyond the stage of making vessels of two or three definite and very simple shapes, which are almost invariably entirely without ornament, or are at best, in a very few cases, ornamented with a simple pattern painted on the flat surface.

The Warrau Redmen inhabiting a neighbouring region have recourse to a picturesque game in order to decide disputes amicably. For this purpose, on an appointed day both parties come together on some open space, such as this sand-bank, each man or boy provided with a large shield made of the leaf-stalks of the aeta palm (*Mauritia flexuosa*). After much shouting and dancing in two opposed lines, the shields of the one party are pushed against those of the other, and by this means the members of each party endeavoured by sheer strength to overthrow, or at least to force back from their position, the members of the other party; and the right in the matter in dispute is considered to lie with whichever party proves itself the stronger in this contest. The game is peculiar to the swamp Warraus, who live in the swamps of the mouths of the Orinoco, and live here chiefly on the aeta palm, not cultivating any food-stuff, but eating the fruit of this palm and the pith of its stem, not making any fermented drink, as other Redmen do, but drinking only water and the sap of this same palm, building their houses, not as Humboldt thought, actually *in* these palms, but yet entirely, floor, posts, and roof, *of* the various parts of this palm.

The physical features of the north-western district are like, yet in some respects different from, those of the rest of the colony. The watershed from which the main rivers, the Waini, Barama, Barima, and the Amakuru, run down to the sea, is here nearer to the coast-line than it is further south. Two more important consequences arise from this. The bare dry savannah of the interior of other parts of the colony is here unrepresented, the whole district being practically within the forest belt. And the rivers are both shorter and deeper, though their mouths are very wide. Moreover, these rivers are curiously connected both by a remarkably elaborate network, probably hardly paralleled in any other part of the world, of natural and semi-natural water channels—such as those described—and by an almost equally elaborate network of Redmen's paths through the forest.

The inhabitants of this district were, ten years ago, Redmen, and Redmen only. Their distribution is interesting when taken in connection with the distribution of their kind throughout the colony. The Redmen of Guiana consist of many small tribes, the best known of which are the Arawacks and the so-called Caribs—true Caribs they are preferably called. These two last-named tribes owe the fact that they are the best known to the circumstance that they shared between them the West Indian Islands south of Jamaica at the time of their discovery by Columbus; and they are the last remnants of those people who were the victims of that brutal policy of extermination by cruelty followed by the Spanish conquerors of the New World. The north-western district is some 9500 square miles in extent, and rises gradually from the sea to the range of somewhat higher land, which is represented, with some exaggeration, on most existing maps as the Sierra Imataca range of mountains, but which, within the limits of British Guiana, never attains a general level of more than 300 or 400 feet. The lower or alluvial part of this country consists of some of the richest soil in the world. Parts which have since been taken in and drained now yield crops of tropical produce of simply amazing abundance. As an illustration, a garden which hardly two and a half years ago was cleared and drained already has in it avenues of trees (*Casuarina*) of over 40 feet high, which were then planted. On the other hand, the higher part of the new district is being fast overrun by very successful gold-diggers.

For geographical reasons the most convenient centre from which to administer the district was at the point at which the Morawhanna leaves the Barima. This is near the centre of the waterway which traverses the northern part of the colony from the sugar fields about the mouth of the Essequibo to its northern limits on the Orinoco, by which, in the absence of roads, all traffic from the Orinoco to the older established parts of the colony must necessarily pass Here, therefore, the central station, with the Government Agency, the police barracks, the hospital, and the other buildings, public and private, which go to make up the chief township, have been placed, and are fast being added to. A large station, with the other necessary accommodation, was also placed at the northern end of the waterway, on the mouth of the Amakuru; and other stations have been placed at intervals along the whole line.

SCIENTIFIC SERIALS.

The *American Meteorological Journal* for May contains a paper read by Prof. W. M. Davis, before the New England Meteorological Society, entitled "Meteorology in the Schools." It points out the best plan to be adopted by a teacher to give his pupils a sound knowledge of the subject, and it will be found full of interest for many who may have made considerable progress in the study of meteorology. The complete solution of weather changes is far beyond the meteorology of the day, but the paper will teach the student to recognize the great difficulties attendant upon successful weather-predictions, and to discriminate between these and the predictions of those who pretend to outline the course of meteorological events for months ahead.—Thunderstorms in New England during the year 1886, by R. De C. Ward. The observation of thunderstorms was taken as a special subject of investigation by the New England Meteorological Society in the years 1885–87, and this paper is a preliminary report on the investigation, to be eventually published by the Harvard College. The storms were most frequent between May and August, and between 5h. and 7h. p.m. The average rate of movement throughout the year was 35 miles an hour. The influence of the tides on the direction of the storms is said to be brought out in several reports.—The storm of March 1–4, 1892, by J. Warren Smith. This storm was so severe in the New England States, and the snowfall and drift so heavy, as to cause in many places the cessation of all outside business; trains were blocked, and much damage done to shipping from the violence of the wind.

The *American Meteorological Journal* for June contains the following original articles:—Flood-stage river predictions, by Prof. T. Russell. The paper gives some account of the methods by which the rules for river-stage predictions are derived. A river-stage is the vertical height of the water surface above the plane of low water, observed with a gauge. There are about 150 gauge stations maintained at various points in the United States. The predictions are mainly based upon observation of the stages and rises at certain points of a stream, and upon a consideration of what has occurred in previous cases, from which data factors are calculated. As a rule, rainfall observations are of little use in such predictions.—The first scientific balloon voyage, translated by R. De C. Ward, from an article by Dr. Hellmann. (See NATURE, vol. xlv. p. 471.)—Snowstorms at Chicago, by A. B. Crane. The writer has tabulated the records relating to the subject from 1879–90, and has discussed them with reference to the meteorological conditions prior to the storm. The heaviest storms occurred in January, the average temperature being 21°·4. He found that before the storms the temperature nearly always rises, and that it rarely falls for twenty-four hours previously.—The eye of the storm, by S. M. Ballou. This name is given to the calm area in the centre of a cyclone, where clear sky is generally visible. The author quotes accounts by various observers, and a review of the different explanations of the phenomenon.—Shall we erect lightning-rods?, by A. McAdie. The question being whether it is

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